

## CLAIMS

*What is claimed is:*

- 50-67
1. A method for providing an inbound controller for a router, the router having an inbound port and an outbound port, a memory, and a CPU, the inbound controller being adapted for receiving an inbound packet at the inbound port, the method comprising:
- providing a plurality of inbound queues for the inbound port;
- receiving an inbound packet at the inbound port;
- 10 classifying the inbound packet in a selected one of the plurality of inbound queues according to packet sorting criteria;
- storing the inbound packet in the selected one of the plurality of inbound queues; and
- determining when one of the plurality of inbound queues is ready to be moved to an outbound queue, the outbound queue being capable of storing a multiplicity of inbound queues.
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2. The method as recited in claim 1, further including:
- asserting an interrupt when it is determined that one of the plurality of inbound queues is ready to be moved to an outbound queue.
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3. The method as recited in claim 1, wherein classifying the inbound packet includes:
- selecting inbound packet sorting criteria;

obtaining packet sorting data for the inbound packet, the packet sorting data being associated with the packet sorting criteria; and

sorting the inbound packet into one of the plurality of inbound queues according to the packet sorting data.

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4. The method as recited in claim 1, the selected one of the plurality of inbound queues corresponding to one of a plurality of outbound queues.

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5. The method as recited in claim 1, wherein storing the inbound packet includes:

obtaining an available packet buffer from a free pool of available packet buffers;

placing the inbound packet in the packet buffer; and

storing the packet buffer in the inbound queue.

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6. The method as recited in claim 1, wherein determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

determining whether a number of packets in one of the plurality of inbound queues exceeds a maximum number of packets.

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7. The method as recited in claim 1, wherein determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

determining whether a number of bytes in one of the plurality of inbound queues exceeds a maximum number of bytes.

5      8.    The method as recited in claim 1, wherein determining when one of the plurality of inbound queues is ready to be moved to an outbound queue further includes:

         determining whether a free pool of available memory has been depleted.

9. The method as recited in claim 1, wherein determining when one of the plurality of inbound queues is ready to be moved to an outbound queue further includes:

determining whether a maximum time limit has been exceeded.

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10. A method for providing an outbound controller for a router, the router having an inbound port and an outbound port, a memory, and a CPU, the outbound controller being adapted for forwarding packets at the outbound port, the method comprising:

10 providing an outbound queue associated with the outbound port and being capable of storing a plurality of inbound queues;

receiving a notification to handle an inbound queue, the inbound queue storing a plurality of packets; and

transferring the inbound queue to the outbound queue.

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11. The method as recited in claim 10, wherein receiving the notification includes:

receiving a notification from the CPU to handle the inbound queue.

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12. The method as recited in claim 10, further including:

transmitting packets stored in the outbound queue.

13. The method as recited in claim 10, wherein transmitting packets includes:

selectively discarding packets stored in the outbound queue.

14. The method as recited in claim 10, wherein transmitting packets stored in the outbound queue further includes:

5 obtaining a next one of the plurality of inbound queues stored in the outbound queue;

transmitting selected packets stored in the next one of the plurality of inbound queues; and

10 releasing memory associated with the next one of the plurality of inbound queues.

15. The method as recited in claim 14, wherein releasing the memory includes:

storing the released memory in a free pool of available packet buffers.

16. The method as recited in claim 14, wherein releasing the memory includes:

forming a new inbound queue to be used by an inbound controller.

20 17. The method as recited in claim 14, wherein releasing the memory includes:

forming a queue to be used by the outbound controller during bi-directional operation.

18. The method as recited in claim 10, wherein transferring the inbound queue to the outbound queue further includes:

ascertaining a priority of the inbound queue; and

transferring the inbound queue to the outbound queue according to the priority of the inbound queue.

19. A method for forwarding a packet in a router, the router having a plurality of inbound ports and a plurality of outbound ports, a memory, and a CPU, the method comprising:

providing a plurality of inbound queues for one of the plurality of inbound ports;

providing a plurality of outbound queues, each one of the plurality of outbound queues corresponding to one of the plurality of outbound ports and being capable of storing a plurality of inbound queues;

receiving an inbound packet at the one of the plurality of inbound ports;

classifying the inbound packet in a selected one of the plurality of inbound queues according to packet sorting criteria;

storing the inbound packet in the selected one of the plurality of inbound queues;

repeating the steps of receiving, providing, classifying, and storing until an interrupt is asserted; and

transferring one of the plurality of inbound queues to one of the plurality of outbound queues corresponding to the packet sorting criteria when the interrupt is asserted.

20. An inbound controller for a router, the router having an inbound port and an outbound port, a memory, and a CPU, the inbound controller being adapted for receiving an inbound packet at the inbound port, comprising:

5 a packet receiving module coupled to the inbound port, the packet receiving module being adapted for receiving an inbound packet;

wherein the memory has stored therein:

a plurality of inbound queues for the inbound port;

10 a classifier adapted for classifying the inbound packet in a selected one of the plurality of inbound queues according to packet sorting criteria;

a packet storing module coupled to the classifier, the packet storing module being adapted for storing the inbound packet in the selected one of the plurality of inbound queues; and

15 a module adapted for determining when one of the plurality of inbound queues is ready to be moved to an outbound queue, the outbound queue being capable of storing a multiplicity of inbound queues.

20 21. The inbound controller as recited in claim 20, further including:

a module adapted for providing the determined one of the plurality of inbound queues.

22. The inbound controller as recited in claim 20, further including:

a module adapted for asserting an interrupt when it is determined that one of the plurality of inbound queues is ready to be moved by the CPU to the outbound queue.

5 23. The inbound controller as recited in claim 20, wherein the packet storing module includes:

a memory obtaining module adapted for obtaining an available packet buffer from a free pool of available packet buffers;

a module adapted for placing the inbound packet in the packet buffer; and

10 a module adapted for storing the packet buffer in the inbound queue.

24. The inbound controller as recited in claim 20, wherein the module adapted for determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

15 a module adapted for determining whether a number of packets in one of the plurality of inbound queues exceeds a maximum number of packets.



25. The inbound controller as recited in claim 20, wherein the module adapted for determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

5 a module adapted for determining whether a number of bytes in one of the plurality of inbound queues exceeds a maximum number of bytes.

26. The inbound controller as recited in claim 20, wherein the module adapted for determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

10 a module adapted for determining whether a free pool of available memory has been depleted.

27. The inbound controller as recited in claim 20, wherein the module adapted for determining when one of the plurality of inbound queues is ready to be moved to an outbound queue includes:

15 a module adapted for determining whether a maximum time limit has been exceeded.

28. An outbound controller for a router, the router having an inbound port and an outbound port, a memory, and a CPU, the outbound controller being adapted for forwarding packets at the outbound port, comprising:

20 a module adapted for receiving a notification to handle an inbound queue, the inbound queue storing a plurality of packets;

wherein the memory has stored therein:

an outbound queue associated with the outbound port and being capable of storing a plurality of inbound queues;

a queue transferring module adapted for transferring the inbound queue to the outbound queue.

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29. The outbound controller as recited in claim 28, wherein the module adapted for receiving the notification includes a module adapted for receiving the notification from the CPU.

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30. The outbound controller as recited in claim 28, further including:

a module adapted for transmitting packets stored in the outbound queue.

31. The outbound controller as recited in claim 30, wherein the module adapted for transmitting packets includes:

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a module adapted for selectively discarding packets stored in the outbound queue.

32. The outbound controller as recited in claim 30, wherein the module adapted for transmitting packets stored in the outbound queue includes:

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a module adapted for obtaining a next one of the plurality of inbound queues stored in the outbound queue;

a packet transmission module adapted for transmitting selected packets stored in the next one of the plurality of inbound queues; and

a memory releasing module adapted for releasing memory associated with the next one of the plurality of inbound queues.

5 33. The outbound controller as recited in claim 32, wherein the memory releasing module includes:

a module adapted for storing the released memory in a free pool of available packet buffers.

10 34. The outbound controller as recited in claim 32, wherein the released memory forms a new inbound queue to be used by an inbound controller.

15 35. The outbound controller as recited in claim 32, wherein the released memory forms a queue to be used by the outbound controller during bi-directional operation.

36. The outbound controller as recited in claim 28, wherein the queue transferring module is adapted for transferring the inbound queue to the outbound queue according to a priority of the inbound queue.

20 37. A router having a plurality of inbound ports and a plurality of outbound ports, a memory, and a CPU, comprising:

an inbound controller coupled to one of the plurality of inbound ports, the inbound controller being adapted for receiving an inbound packet;

wherein the memory has stored therein:

a plurality of inbound queues for the one of the plurality of inbound ports;  
and

a plurality of outbound queues, each one of the plurality of outbound  
queues corresponding to one of the plurality of outbound ports and being  
capable of storing a plurality of inbound queues;

a classifier coupled to the inbound controller, the classifier being adapted  
for classifying the inbound packet in a selected one of the plurality of inbound  
queues according to packet sorting criteria, the selected one of the plurality of  
inbound queues being associated with one of the plurality of outbound queues;

wherein the inbound controller is adapted for storing the inbound packet in  
the selected one of the plurality of inbound queues.

38. The router as recited in claim 37, further including:

an outbound controller coupled to the inbound controller;

wherein the inbound controller selects one of the plurality of inbound  
queues to be transferred to the outbound controller;

wherein the outbound controller is adapted for storing the selected one of  
the plurality of inbound queues in one of the plurality of outbound queues  
associated with the packet sorting criteria and transmitting packets stored in the  
one of the plurality of outbound queues.

39. The router as recited in claim 37, wherein the inbound controller further  
includes:

a memory obtaining module coupled to the classifier, the memory  
obtaining module being adapted for obtaining memory for an inbound packet to

permit the inbound packet to be stored in the selected one of the plurality of inbound queues in which the inbound packet is classified.

5 40. The router as recited in claim 38, wherein the outbound controller further includes:

a memory releasing module adapted for releasing selected packet buffers associated with packets stored in the one of the plurality of outbound queues.

10 41. The router as recited in claim 40, wherein the memory further includes a free pool of available packet buffers and the memory releasing module is adapted for releasing the selected packet buffers into the free pool.

42. The router as recited in claim 38, wherein the outbound controller further includes:

15 a memory releasing module adapted for providing a new inbound queue to the inbound controller to replace the selected one of the plurality of inbound queues.

43. An encryption system, comprising:

20 an inbound controller adapted for receiving an inbound packet;  
a classifier coupled to the inbound controller and adapted for classifying and storing the inbound packet in an inbound queue;  
an outbound controller adapted for receiving the inbound queue; and

an encryption box coupled to the outbound controller, the encryption box being adapted for encrypting the inbound queue to provide an encrypted inbound queue to the outbound controller for transmission.

- 5      44. The encryption system as recited in claim 43, wherein the outbound controller includes an outbound classifier adapted for classifying the encrypted inbound queue in an outbound queue, the outbound controller adapted for transmitting data stored in the outbound queue.

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